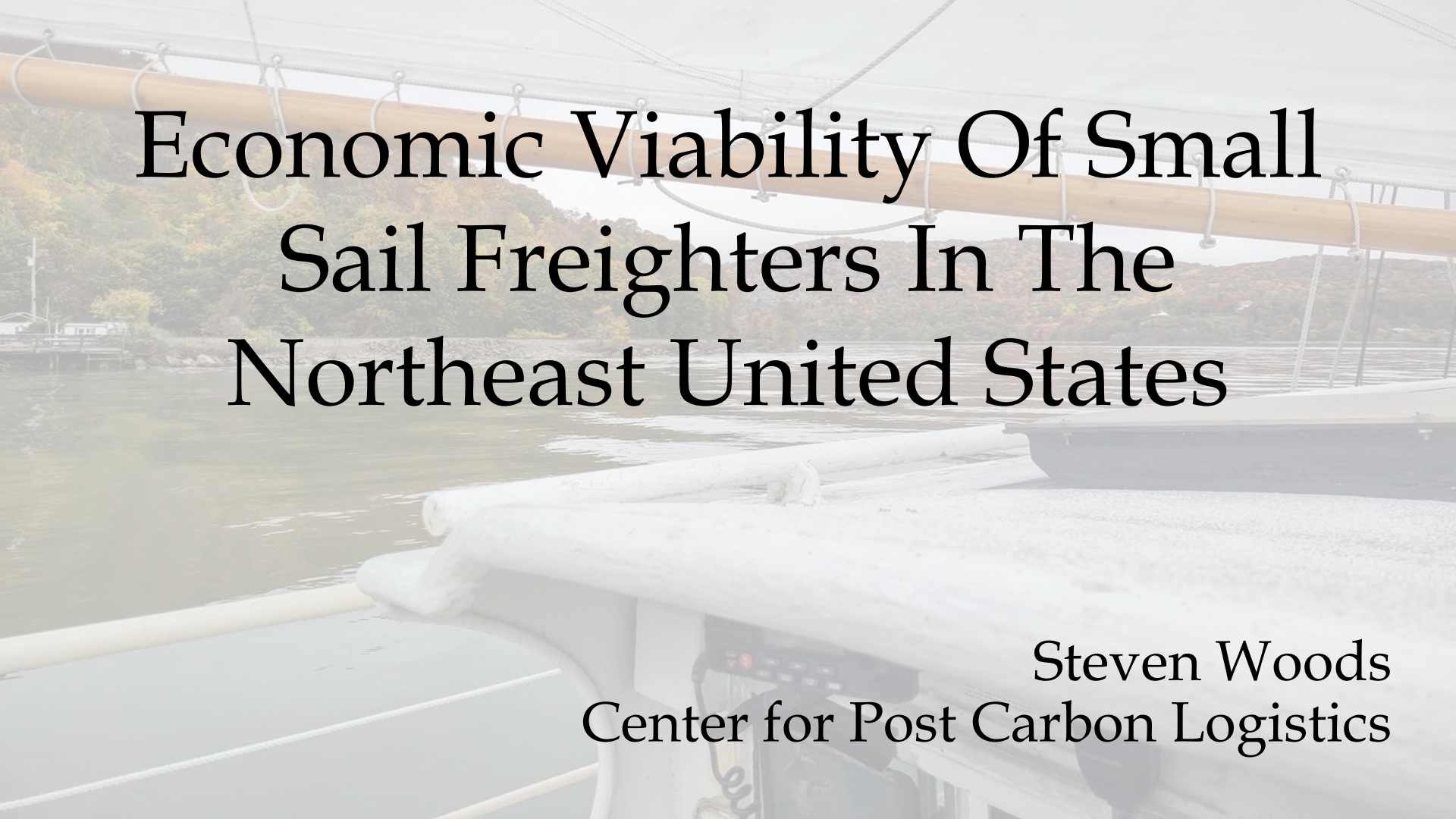
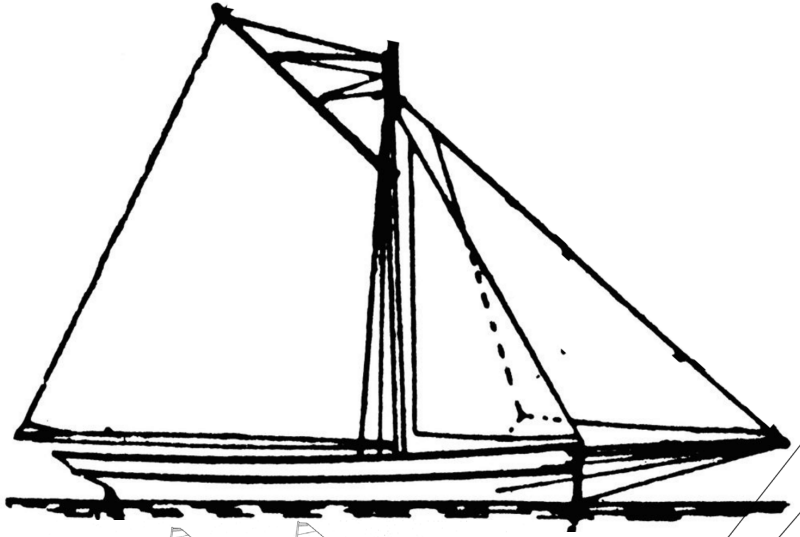
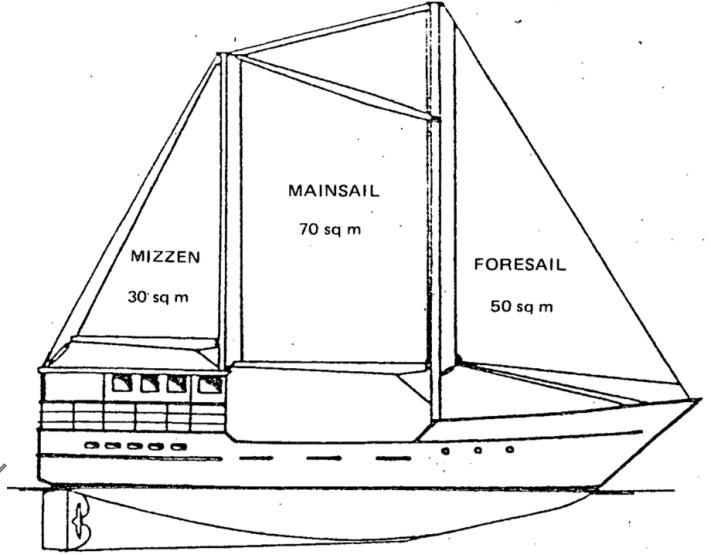


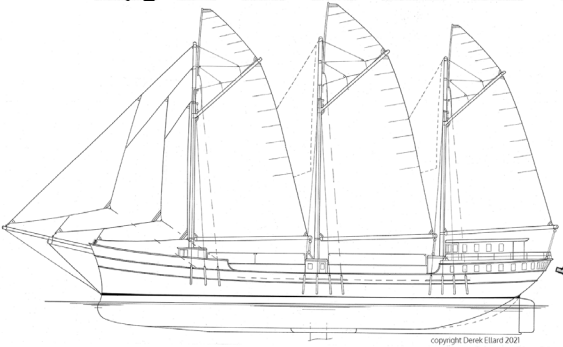
Economic Viability Of Small Sail Freighters In The Northeast United States

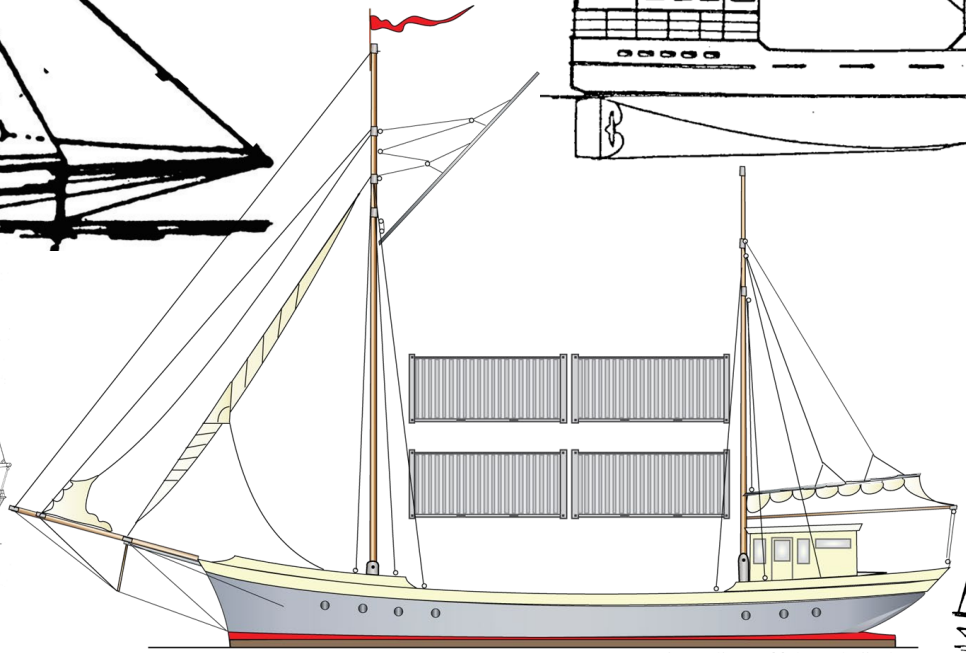
Steven Woods
Center for Post Carbon Logistics

Small Vessel Sector:

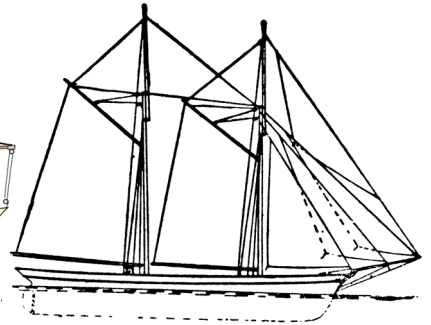








Electric Clipper 100 © Derek Ellard



The Center for

Post Carbon Logistics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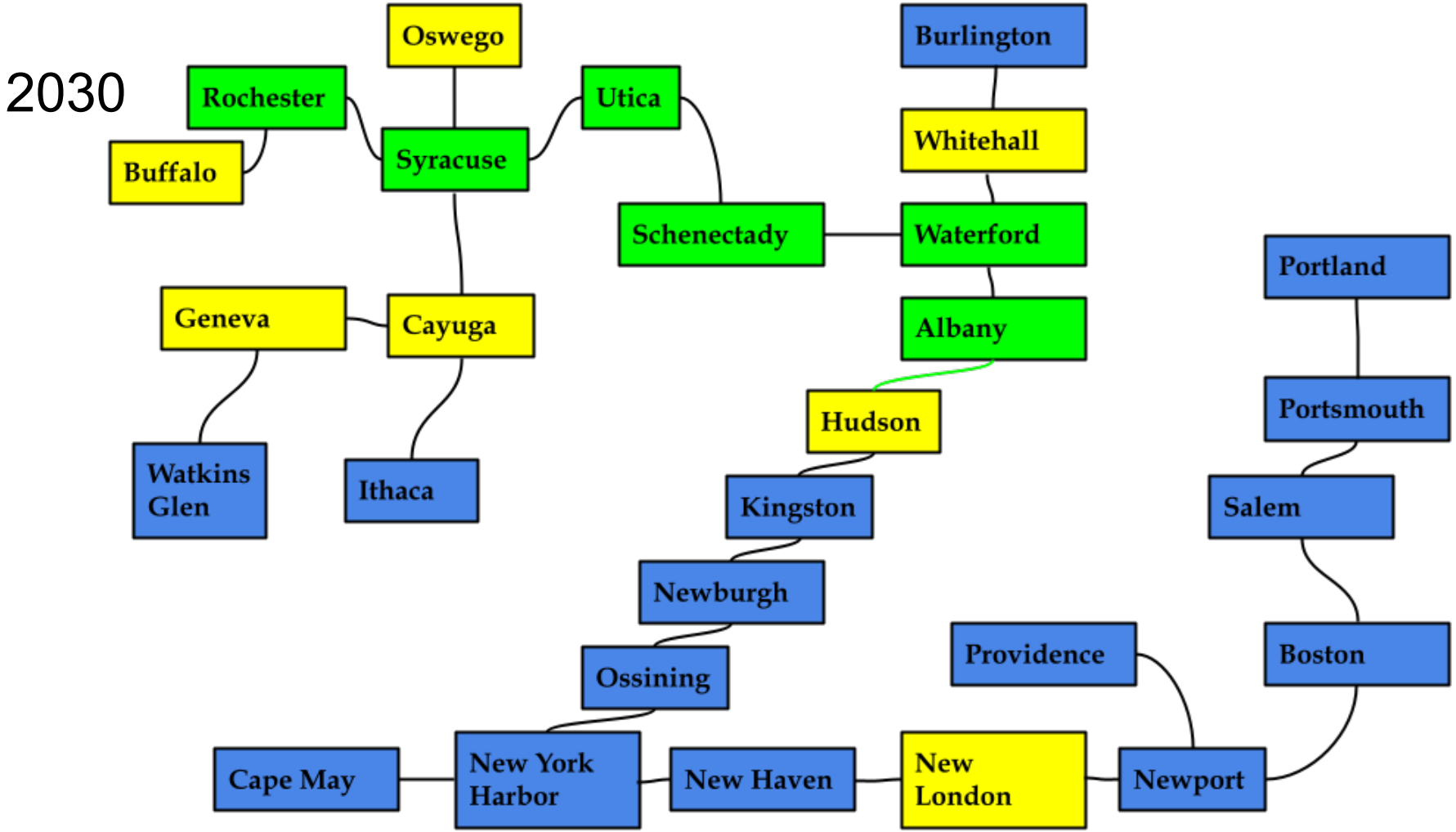
M-295


2030
Oswego
Rochester
Utica
Burlington
Buffalo
Syracuse
Whitehall
Schenectady
Waterford
Portland
Geneva
Cayuga
Albany
Hudson
Portsmouth
Watkins Glen
Ithaca
Kingston
Salem
Newburgh
Providence
Boston
Ossining
Cape May
New York Harbor
New Haven
New London
Newport

Less-than Truck Load (LTL) Shipping

Consolidates many small shipments into one large truckload.

Most loads of 1-4 pallets each.

Truck drives a route making pickups and dropoffs throughout.

Generally more expensive per unit than FTL (Full Truck Load) shipping.

This is the most logical customer base for small sail freighters in early stages.

The Example Cargo

4x4x4 foot pallet of Malt.

Weight 2000 Lbs.

Stowage Factor 64 cubic ft per short ton.

Non - hazardous, non - alcoholic.

Delivered with no extra accommodations or requirements (lift gate, etc)

TABLE 2: ROUTE INFORMATION

Route	Sailing Miles	Days Sailing	Voyages/yr	Truck Miles
Portland-Boston	100	1	320	107
Boston-New York	400	4	85	216
New York-Cape May	128	2	180	158
New Haven-Port Jefferson	23	1	350	117
Newport-Martha's Vineyard	45	1	350	45
Newport-Block Island	26	1	350	40[12]
Buffalo-Albany (via Erie Canal)	363	5	36	288
Burlington-New York (Via Champlain Canal)	267	5	36	298

TABLE 1: VESSEL ASSUMPTIONS

Assumption	15 GRT	25 GRT	50 GRT	100 GRT	Notes
Fuel per day	4 gal	4 gal	4 gal	4 gal	At $5/gallon
Crew strength	2	4	6	6	
Hold Capacity, ft^3	480	960	2,240	4,480	64 ft^3 per pallet
Cargo Deadweight Tonnage	7.5	15	35	70	Short tons
Construction Cost ($)	500,000	750,000	1,000,000	2,000,000	
Length Over Spars (ft)	45	60	72	95	For docking fees

Values from Woods. "A Service-Pattern Sail Freighter: The Need for a Scalable Open-Source Sail Freighter Design." *Proceedings of the Sustainability in Ship Design and Operation Conference 2023.* Glen Cove: Webb Institute, 2024.

TABLE 4: REQUIRED FREIGHT RATES BY FREIGHTER CAPACITY AND ROUTE

ROUTE	15 GRT	25 GRT	50 GRT	100 GRT
Portland-Boston	186.64	161.90	112.97	91.00
Boston-New York	549.02	477.33	305.40	157.08
New York-Cape May	294.95	258.33	172.25	130.95
Port Jefferson-New Haven	163.24	146.48	104.81	84.84
Newport-Martha's Vineyard	163.24	146.48	104.81	84.84
Newport-Block Island	~~163.24~~	~~146.48~~	104.81	84.84
Buffalo-Albany via Erie Canal	~~1,027.72~~	~~692.56~~	~~385.98~~	~~338.55~~
Burlington-New York via Champlain Canal	~~1,027.72~~	~~692.56~~	385.98	338.55

Notes: Non-Competitive routes are ~~struck through.~~ Competitive Rate is any within 10% of rate quoted above. RFRs calculated using a 10 year payoff for vessel construction.

Portland-Boston:	$ 222	($2.07 /ton-mile)
Boston-New York:	$ 521	($2.41 /ton-mile)
New York-Cape May:	$ 285	($1.80 /ton-mile)
New Haven-Port Jefferson:	$ 280	($2.39 /ton-mile)
Newport-Martha's Vineyard:	$ 738	($16.40 /ton-mile)
Newport-Block Island:	$ 130	($3.25 /ton-mile)
Buffalo-Albany:	$ 192	($0.66 /ton-mile)
Burlington-New York:	$ 470	($1.58 /ton-mile)

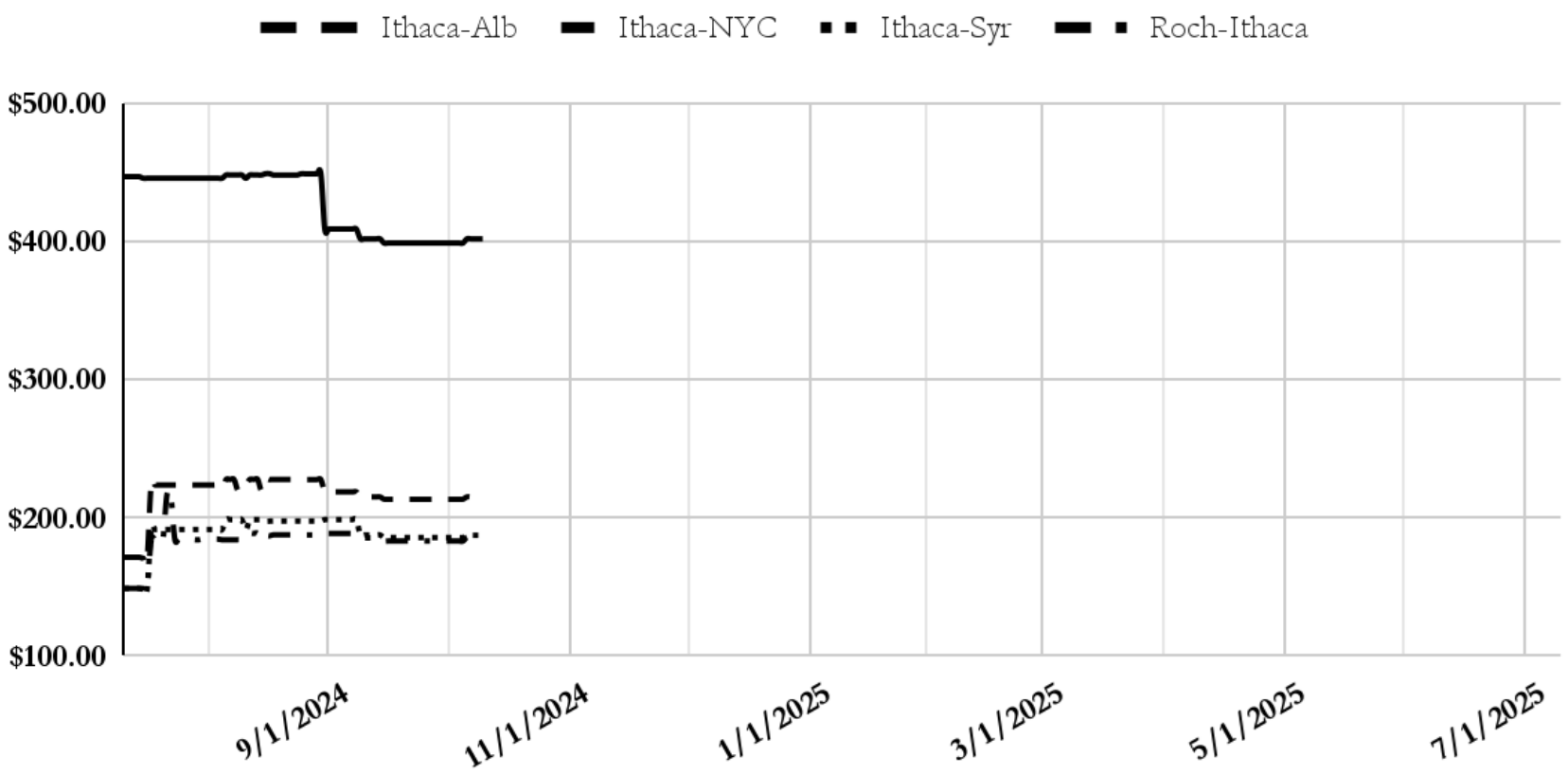
TABLE 3: BREAKEVEN LOAD FACTOR BY FREIGHTER CAPACITY AND ROUTE

ROUTE	15 GRT	25 GRT	50 GRT	100 GRT
Portland-Boston	83%	73%	51%	41%
Boston-New York	~~F&D~~	91%	59%	43%
New York-Cape May	~~F&D~~	90%	60%	46%
Port Jefferson-New Haven	58%	52%	38%	31%
Newport-Martha's Vineyard	22%	20%	15%	12%
Newport-Block Island	~~F&D~~	~~F&D~~	81%	65%
Buffalo-Albany via Erie Canal	~~F&D~~	~~F&D~~	~~F&D~~	~~F&D~~
Burlington-New York via Champlain Canal	~~F&D~~	~~F&D~~	81%	71%

Notes: Non-viable routes are ~~struck through.~~ F&D represents "Full and Down" condition.[17]

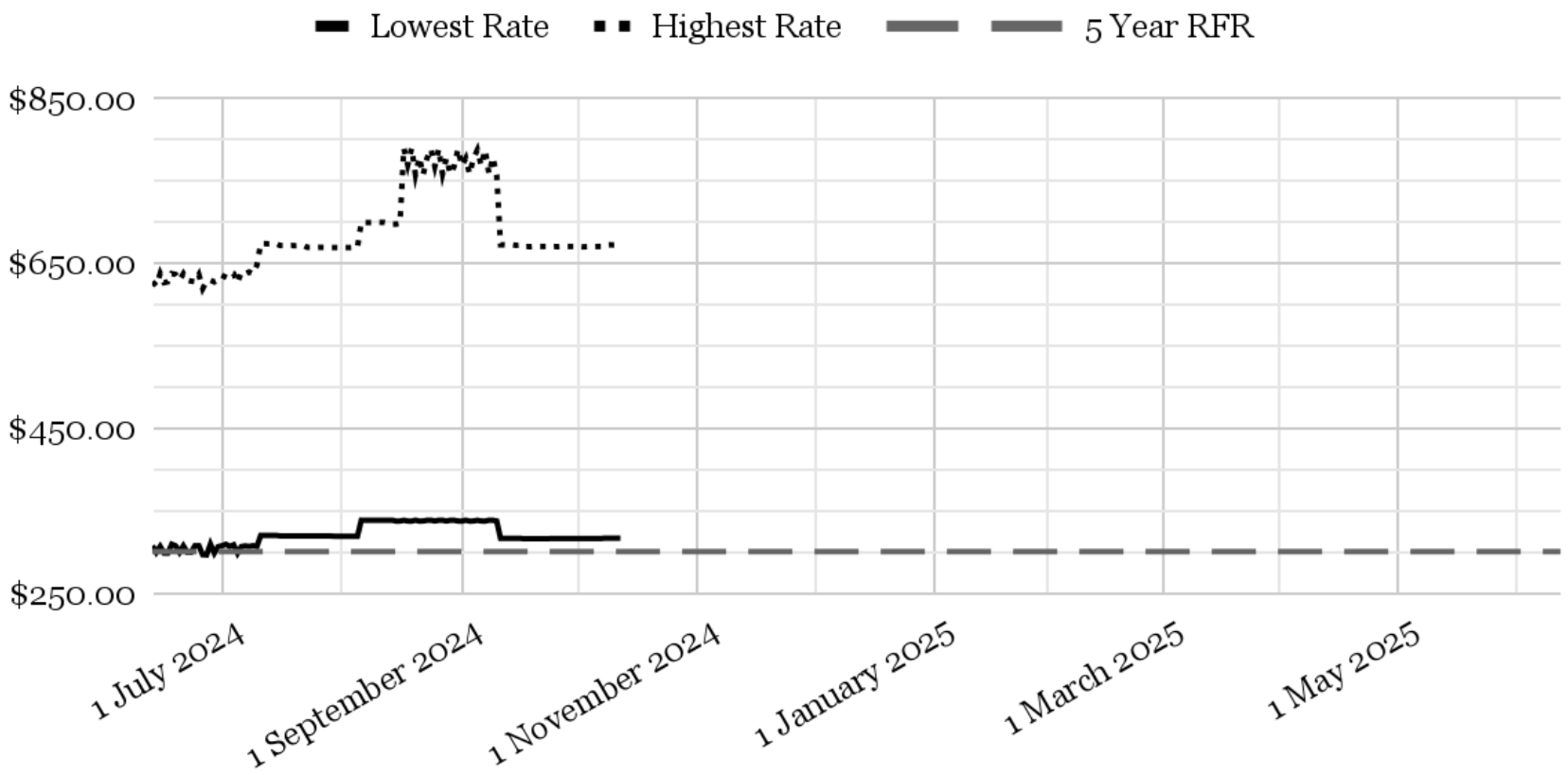
Ithaca Trade Route Rates

64 Cubic Foot Pallet Of Malt Weighing 2,000 Pounds.



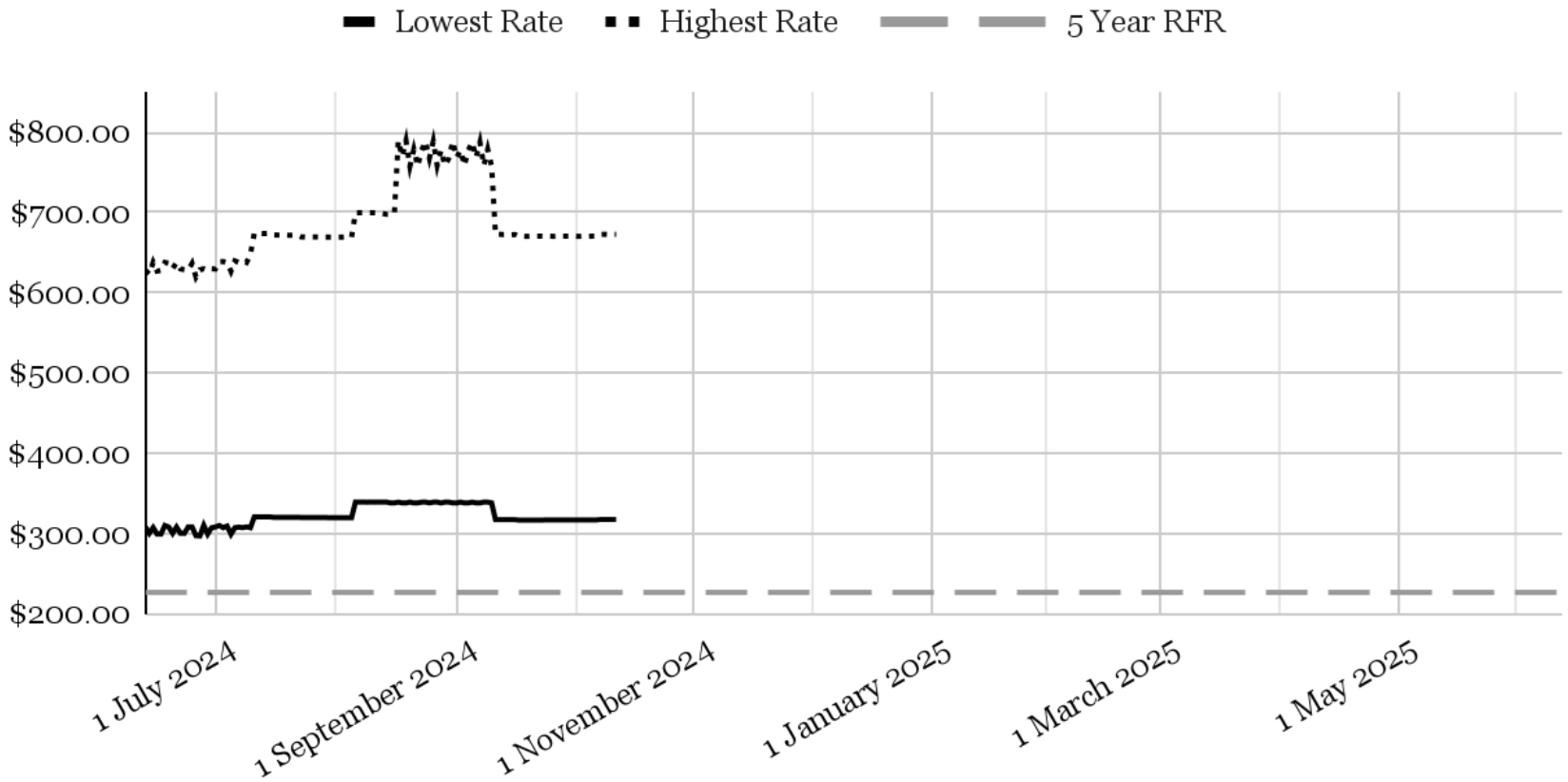
Trucking Rates from Boston to Provincetown

Highest and Lowest Rate for 64 Cubic Foot pallet of Malt weighing 2,000 Pounds.



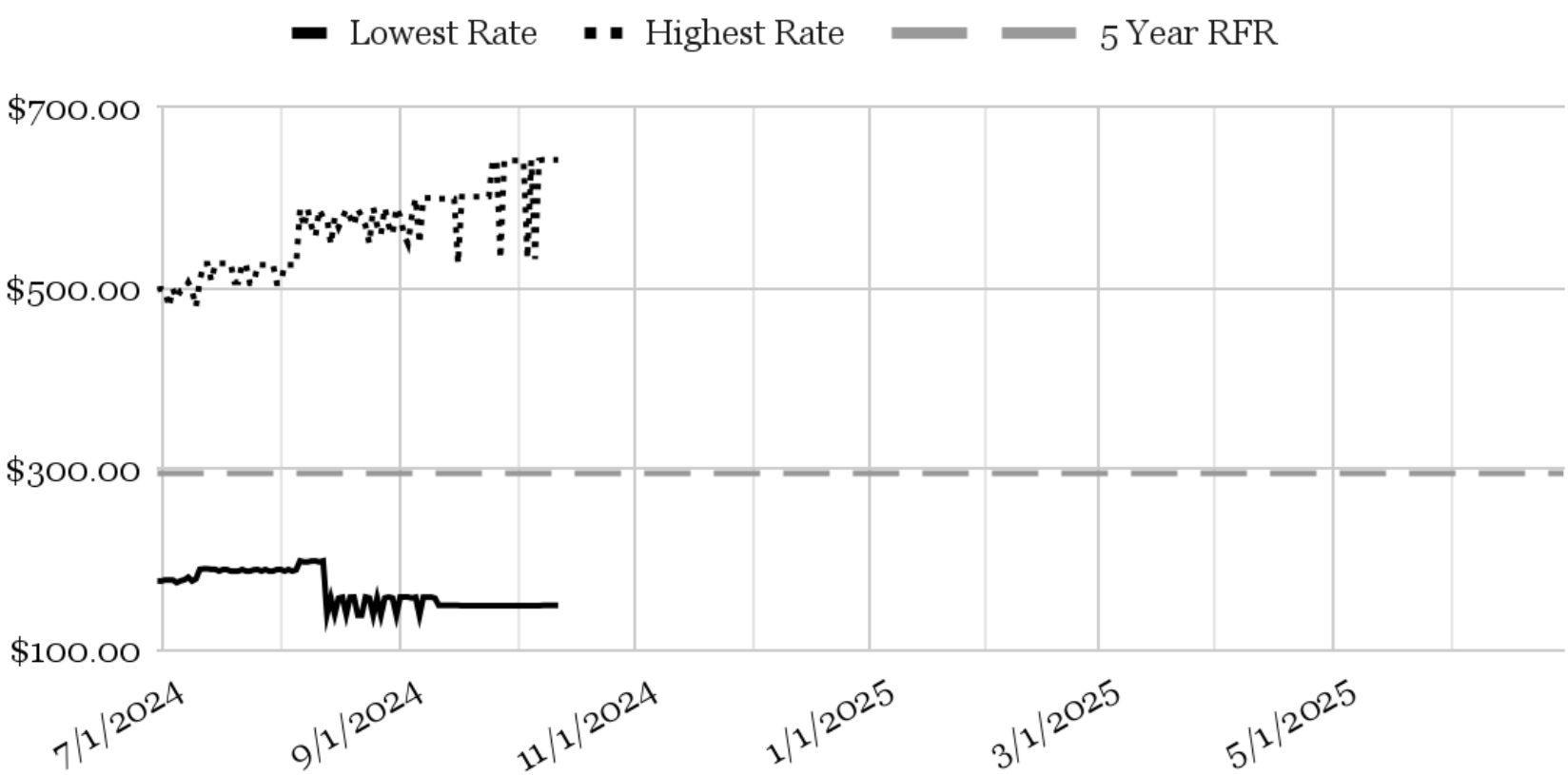
Boston-Provincetown Price Competition Data

64 Cu Ft Pallet of Malt weighing 2000 pounds. 25 GRT/18 CDWT Schooner.



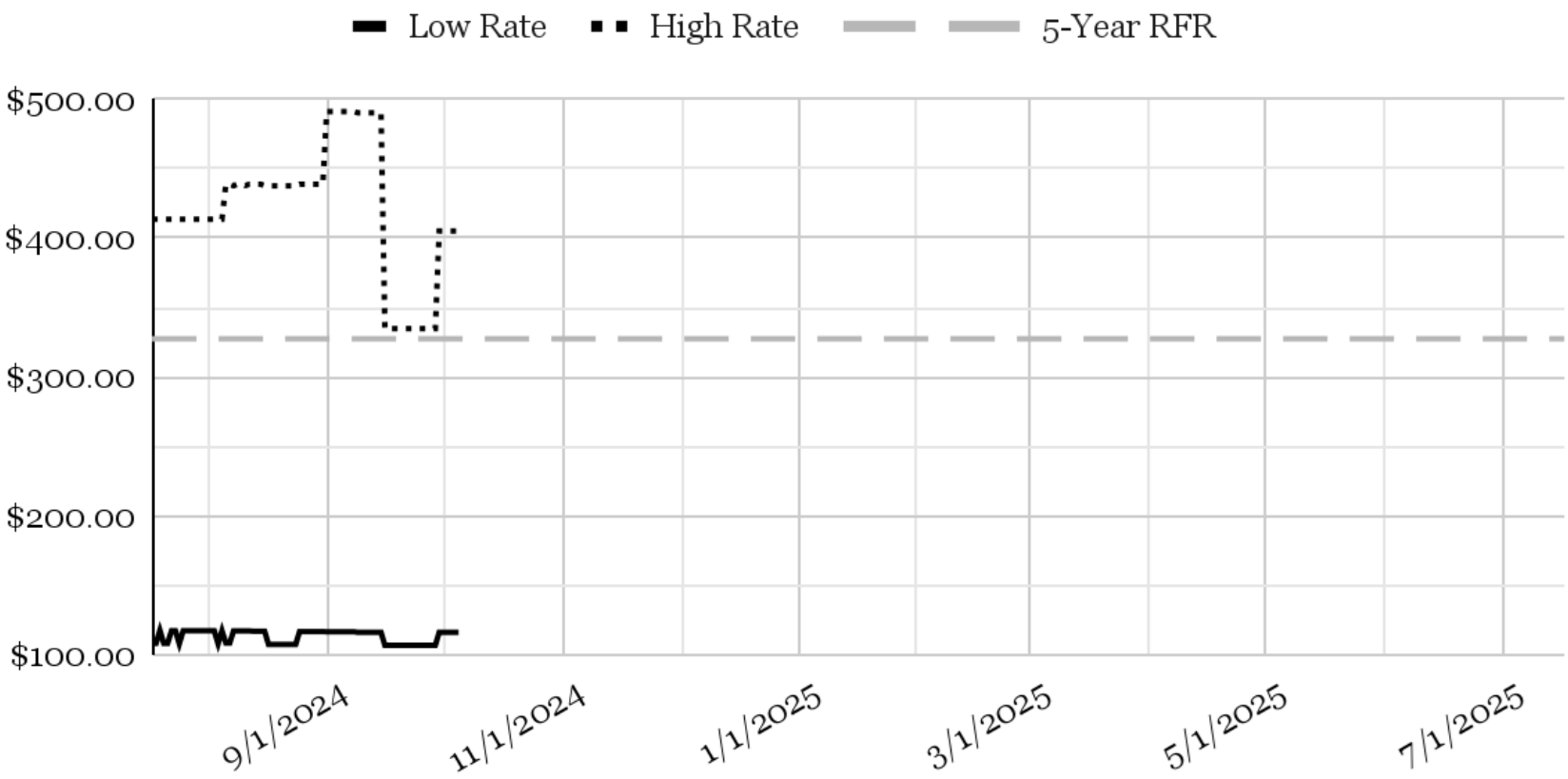
Trucking Rates From Boston to Gloucester

Highest and Lowest Rate For 64 Cu Ft Pallet of Malt weighing 2,000 pounds.



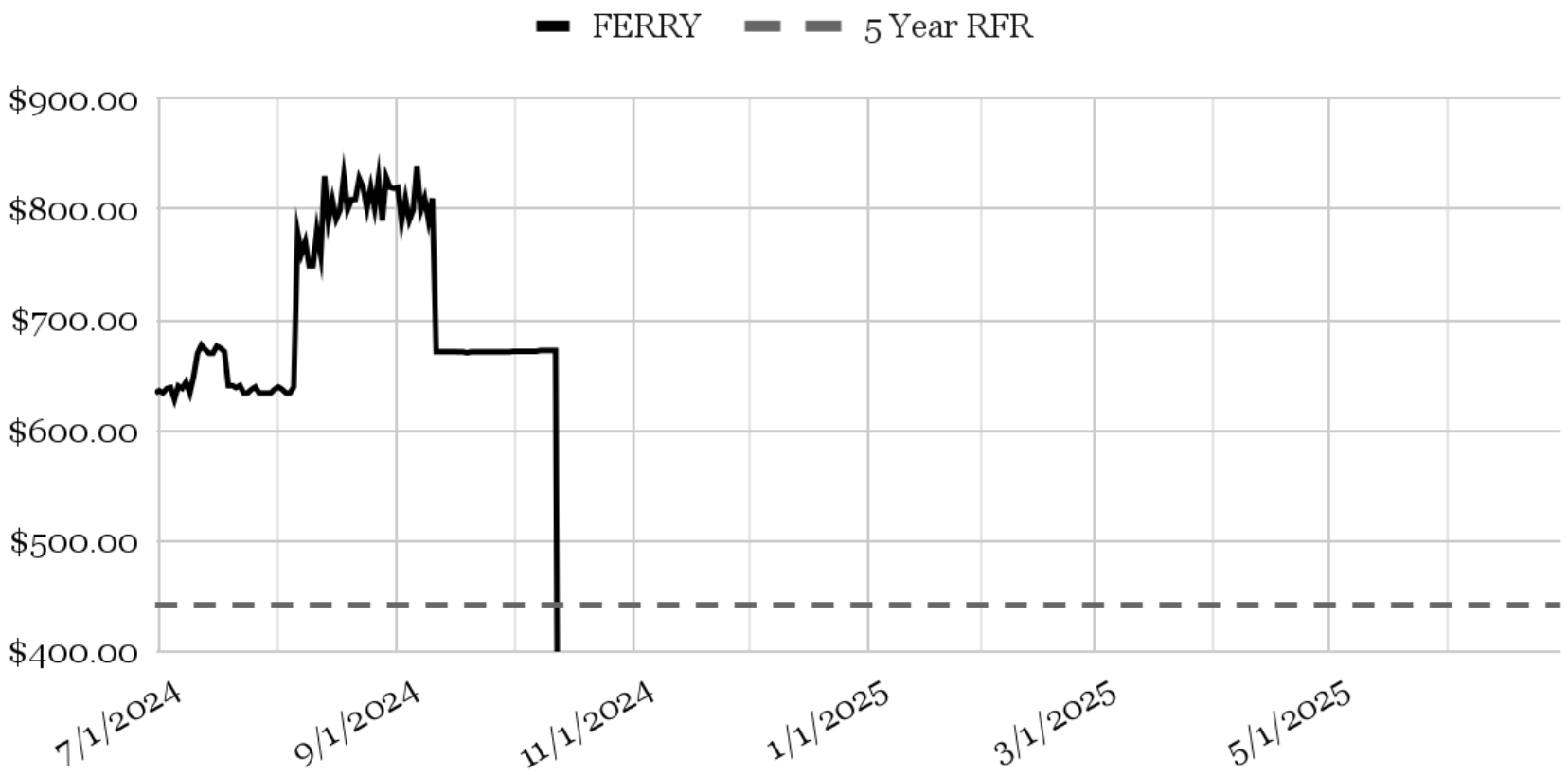
Newport-Block Island Freight Rate Information

64 Cu Ft pallet of malt weighing 2000 lbs.



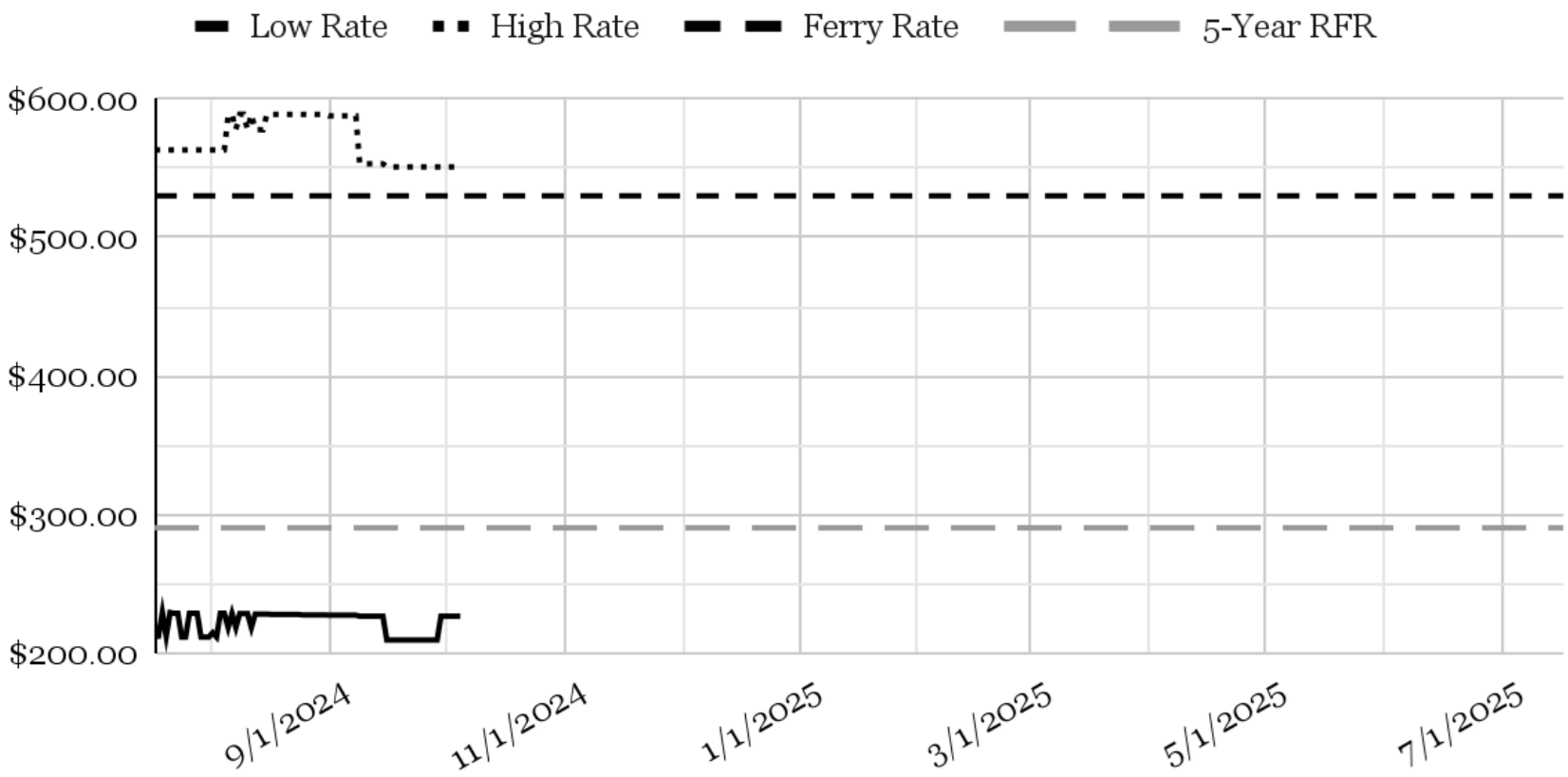
Ferry Rates From New Bedford To Vineyard Haven.

2,000 lb, 64 C.Ft Pallet. Boston - Vineyard Haven fare minus Boston - New Bedford fare.



New Bedford-Hyannis Ferry Rates Window

64 Cu Ft 2000 lb pallet of malt. 10 CDWT Schooner, No Backhaul.



This Presentation Uses 10 CDWT Vessels.

Routes Shown Assume Undercutting Trucks.

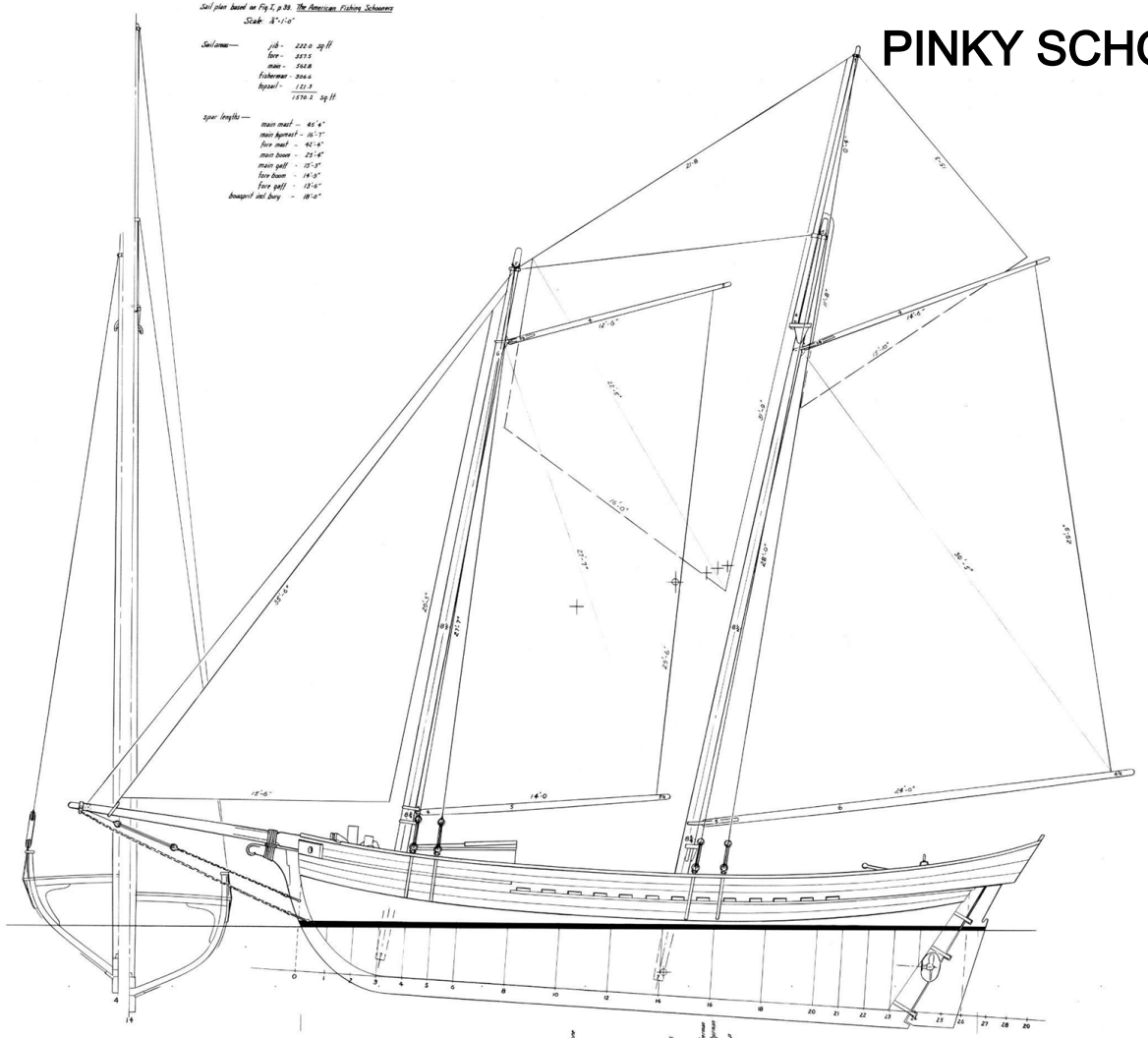
Detailed Financials Are Available By Request.

Route Analysis Available By Request.

Paper In Journal Of Merchant Ship Wind Energy.

PINKY SCHOONER

MAINE



ASSUMPTIONS:

Ship Building: $500,000

Insurance: 10%

Longshore Fee: $20/Port

Crew: 2

Maintenance: 10%

Fuel: 0.125 gal/day@ $5

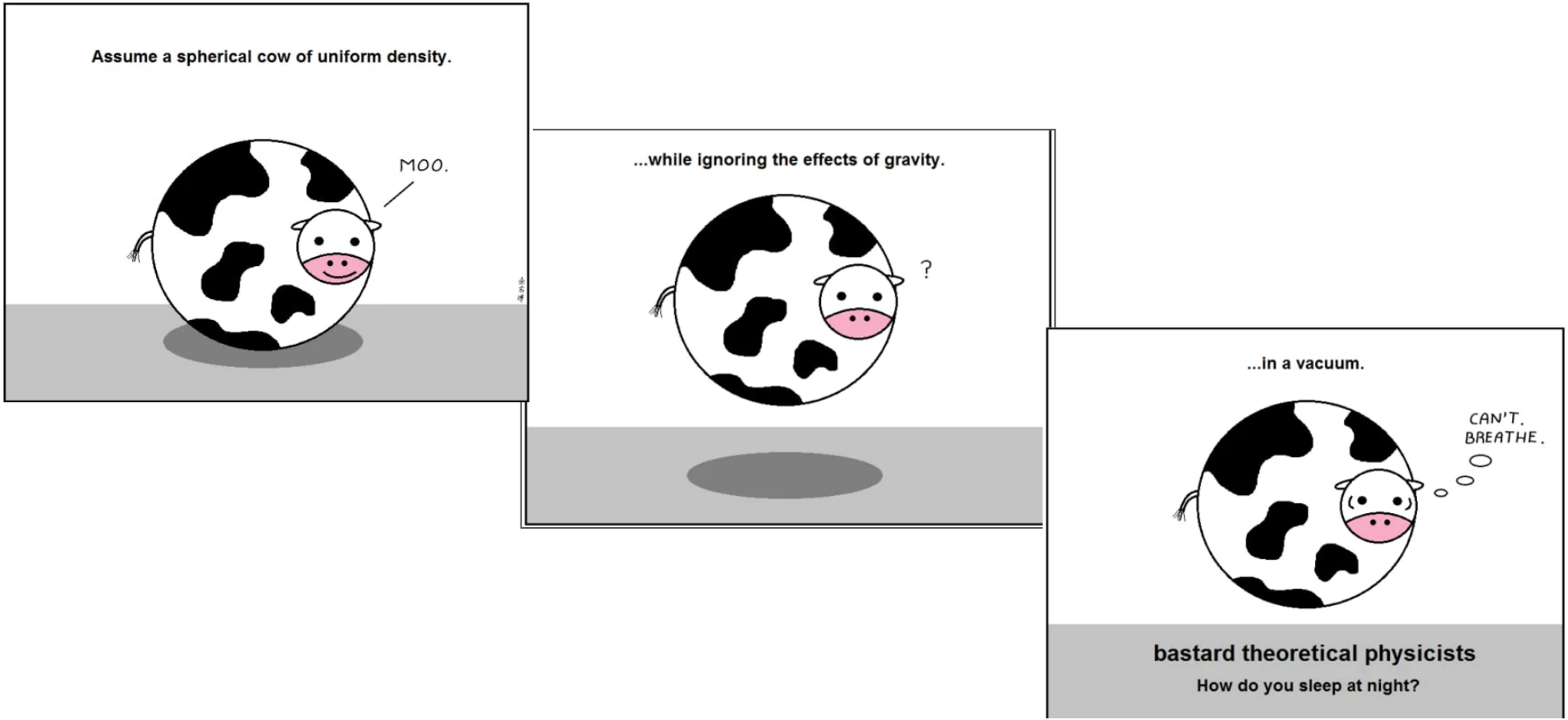
Marina Membership: $500/ft

Port Fees: $9/ft

No Backhaul Cargo

130 Voyages/Year

Spherical Cows Are Friends (Not Food)



IS IT REALLY VIABLE?

Can Sailors Afford To Take This Job?

- ☛ US Average Income in 2022 was $51,123 (US Census Bureau)
- ☛ $200 Per Sailor Day gives approximately $52,000 per year on most routes.
- ☛ Additional $25 per sailor day for provisioning gives + $6,500 per year.
- ☛ Employee Ownership Program can increase sailor income, if available.
- ☛ A Living Wage for a single person in Boston is $62,000 Gross Income.

TABLE 5: ANNUAL EMISSIONS IMPACT BY ROUTE IN METRIC TONS CO2

ROUTE	15 GRT	25 GRT	50 GRT	100 GRT
Portland-Boston	141.3	295.4	706.2	1,425.3
Boston-New York	69	151.6	372	757.5
New York-Cape May	113.6	241.6	582.8	1,180.1
Port Jefferson-New Haven	170.3	354.6	846	1705.9
Newport-Martha's Vineyard	56.9	127.8	316.8	647.5
Newport-Block Island	49	112	280	574
Buffalo-Albany via Erie Canal	39.5	86.1	210.5	428.3
Burlington-New York via Champlain Canal	41.1	89.4	218.1	443.4
One Vessel Working Each Route:	**680.7**	**1,458.5**	**3,478.4**	**7,162**

This table gives the maximum carbon emissions each sail freighter can save by mode shifting cargo away from trucking.

SAIL FREIGHT PROJECT FINANCIAL PROJECTIONS
ROUTE: Boston-Provincetown
VESSEL: Pinky Schooner Maine
YEAR 1: 130x 2-Day Voyages, Full & Down, 10 CDWT. No Backhaul.

Line-Item	Quantity	Per Unit	Amount
Stock, Sold By Shares	5,000	$100.00	500,000.00
Honorary Shipowner Certificates	-	$35.00	-
Gross Revenue, Freight	1,300	$310.86	404,117.45
Gross Revenue			**904,117.45**
Vessel Purchase	1	$500,000.00	500,000.00
Insurance	1	$50,000.00	50,000.00
Crew Labor, per Sailor Day	520	$200.00	104,000.00
Winter Storage, per ft	44	$0.00	-
Seasonal Marina Slip, per foot	44	$500.00	22,000.00
Fuel, Diesel, Per Gallon	33	$5.00	162.50
Maintenance Costs	1	$50,000.00	50,000.00
Provisioning, per person-day	520	$25.00	13,000.00
Longshore Labor Fees, per pallet	2,600	$20.00	52,000.00
Port Fees Per Day	235	$0.00	-
Total Expenses			**791,162.50**
Net Income			**112,954.95**

SAIL FREIGHT PROJECT FINANCIAL PROJECTIONS
ROUTE: Boston-Glocester
VESSEL: Pinky Schooner Maine
YEAR 1: 160x 2-Day Voyages, Full & Down, 10 CDWT. No Backhaul.

Line-Item	Quantity	Per Unit	Amount
Stock, Sold By Shares	5,000	$100.00	500,000.00
Honorary Shipowner Certificates	-	$35.00	-
Gross Revenue, Freight	1,300	$184.66	240,058.43
Gross Revenue			**740,058.43**
Vessel Purchase	1	$500,000.00	500,000.00
Insurance	1	$50,000.00	50,000.00
Crew Labor, per Sailor Day	520	$200.00	104,000.00
Winter Storage, per ft	44	$0.00	-
Seasonal Marina Slip, per foot	44	$350.00	15,400.00
Fuel, Diesel, Per Gallon	33	$5.00	162.50
Maintenance Costs	1	$50,000.00	50,000.00
Provisioning, per person-day	520	$25.00	13,000.00
Longshore Labor Fees, per pallet	2,600	$20.00	52,000.00
Port Fees Per Day	365	$0.00	-
Total Expenses			**784,562.50**
Net Income			**(44,504.07)**

SAIL FREIGHT PROJECT FINANCIAL PROJECTIONS
ROUTE: New Bedford-Martha's Vineyard
VESSEL: Pinky Schooner Maine
YEAR 1: 130x 2-Day Voyages, Full & Down, 10 CDWT. No Backhaul.

Line-Item	Quantity	Per Unit	Amount
Stock, Sold By Shares	5,000	$100.00	500,000.00
Honorary Shipowner Certificates	0	$35.00	-
Gross Revenue, Freight	1,300	$646.86	840,920.60
Gross Revenue			**1,340,920.60**
Vessel Purchase	1	$500,000.00	500,000.00
Insurance	1	$50,000.00	50,000.00
Crew Labor, per Sailor Day	520	$200.00	104,000.00
Winter Storage, per ft	44	$0.00	-
Seasonal Marina Slip, per foot	44	$500.00	22,000.00
Fuel, Diesel, Per Gallon	33	$5.00	162.50
Maintenance Costs	1	$50,000.00	50,000.00
Provisioning, per person-day	520	$25.00	13,000.00
Steamship Authority License, 20%	1	$168,184.12	168,184.12
Longshore Fees	2,600	$20.00	52,000.00
Total Expenses			**959,346.62**
Net Income			**381,573.98**

SAIL FREIGHT PROJECT FINANCIAL PROJECTIONS
ROUTE: New Bedford-Martha's Vineyard
VESSEL: 50 GRT Schooner with 6 Crew
YEAR 1: 130x 2-Day Voyages, Full & Down, 35 CDWT. No Backhaul.

Line-Item	Quantity	Per Unit	Amount
Stock, Sold By Shares	10,000	$100.00	1,000,000.00
Honorary Shipowner Certificates	0	$35.00	-
Gross Revenue, Freight	4,550	$646.86	2,943,222.10
Gross Revenue			**3,943,222.10**
Vessel Purchase	1	$1,000,000.00	1,000,000.00
Insurance	1	$100,000.00	100,000.00
Crew Labor, per Sailor Day	1,560	$300.00	468,000.00
Winter Storage, per ft	72	$0.00	-
Longshore Fees	9,100	$20.00	182,000.00
Fuel, Diesel, Per Gallon	260	$5.00	1,300.00
Maintenance Costs	1	$100,000.00	100,000.00
Provisioning, per person-day	1,560	$25.00	39,000.00
Steamship Authority License, 20%	1	$588,644.42	588,644.42
Port Fees Per Day	365	$648.00	236,520.00
Total Expenses			**2,715,464.42**
Net Income			**1,227,757.68**

SAIL FREIGHT PROJECT FINANCIAL PROJECTIONS
ROUTE: Boston-Provincetown
VESSEL: Salvage 36 ft Sailboat
YEAR 1: 130 Voyages, Full & Down, 5 CDWT.

Line-Item	Quantity	Per Unit	Amount
Stock, Sold By Shares	250	$100.00	25,000.00
Honorary Shipowner Certificates	-	$35.00	-
Gross Revenue, Freight	650	$310.86	202,058.72
Gross Revenue			**227,058.72**
Vessel Purchase	1	$25,000.00	25,000.00
Insurance	1	$2,500.00	2,500.00
Crew Labor, per Sailor Day	520	$200.00	104,000.00
Winter Storage, per ft	36	$0.00	-
Seasonal Marina Slip, per foot	36	$500.00	18,000.00
Fuel, Diesel, Per Gallon	33	$5.00	162.50
Maintenance Costs	1	$2,500.00	2,500.00
Provisioning, per person-day	520	$25.00	13,000.00
Longshore Labor Fees, per pallet	1,300	$20.00	26,000.00
Port Fees Per Day	365	$0.00	-
Total Expenses			**191,162.50**
Net Income			**35,896.22**

BOSTON-PROVINCETOWN ROUTE

EXTERNALITY BALLANCE SHEET: FINANCIAL, Kg CO2e

OPERATIONAL SCOPE 1 ONLY.

BENEFITS, USD		LIABILITIES, USD	
Transportation	$66,239.	Fuels Burned	$725.
Road Maint. Avoided	$5,500.43	Cooking Fuels Burned	$98.8
Physical Plant & Equip	$0.00	Physical Plant & Equi	$19.72
Inventory	$0.00	Inventory	$0.00
TOTAL ASSETS	**$71,740.22**	**TOTAL LIABILITIES:**	**$1,144.05**

BENEFITS, CO2e		LIABILITIES, CO2e	
Transportation	0,054.35	Propulsion Fuels	329.16
NON-GHG Values		Cooking Fuel Burned	135.60
Physical Plant & Equip	0.00	Physical Plant & Equip	54.32
Inventory	0.00	Inventory	
TOTAL ASSETS:	**30,054.35**	**TOTAL LIABILITIES:**	**519.08**

SOCIALLY NET POSITIVE?

NOTES:

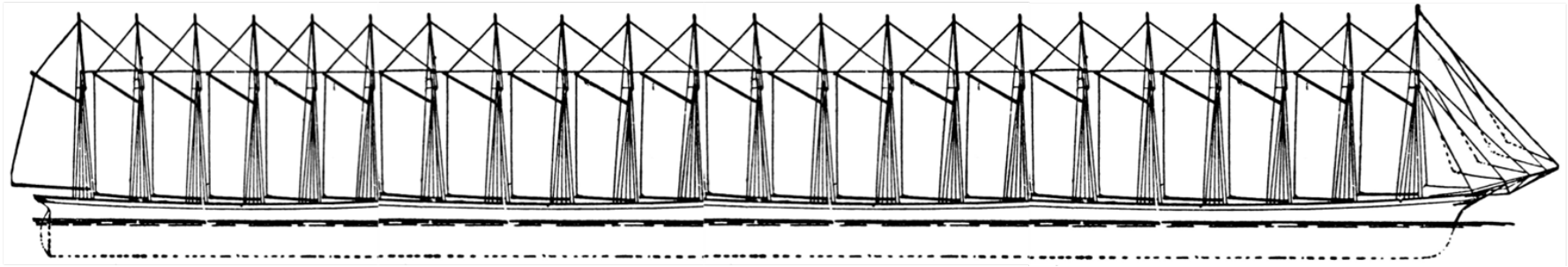
Cooking Emissions will be eliminated through electrification within two seasons.

Benefits of 0-Carbon Last-Mile transp. exclusive.

Upgrades to electric auxilary propulsion will eliminate propulsion liabilities in future years.

Social Cost of Carbon per EPA: $2.204/kg CO2e.


EXIT 8
Atlantic Street
NEXT RIGHT
EXIT 7
137 NORTH
Greenwich Avenue



Questions?

Steven@PostCarbonLogistics.org